ARCADIS
Infrastructure, environment, facilities

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H. Thomas Fridirici
Water Supply Management Program
Pennsylvania Department of Environmental Protection
Southcentral Region
909 Elmerton Avenue
Harrisburg, PA 17110-8200

Subject:
Addendum to Bally Water Resources Investigation Report

ENVIRONMENT

Dear Mr. Fridirici:

ARCADIS, on behalf of Sunbeam, is pleased to submit this letter and the attached Addendum to the Detailed Hydrogeologic Water Resources Investigation Report, Bally Groundwater Contamination Superfund Site (Site), Bally, PA (WRI Report) to address the comments that you provided in your May 9, 2006 email and subsequent May 11, 2006 conversation with ARCADIS.

Since our last conversation, ARCADIS has been in frequent contact with both the Borough and U.S. EPA regarding the proposed municipal supply well discussed in the abovementioned report. During a meeting held on July 6, 2006 including representatives from ARCADIS, Sunbeam, U.S. EPA, PADEP and the Borough, Mitch Cron, the USEPA Remedial Project Manager (RPM) for the Site, supported our proposed water supply well as the most viable solution to be proposed as the remedy in the Focused Feasibility Study for the Site. In a subsequent Bally Borough Council meeting held on August 29, 2006, the Borough Council agreed to accept the new well location.

ARCADIS believes that, in conjunction with the above stated facts, the attached information should be sufficient to satisfy your questions and provide you with the requisite level of confidence necessary for you to state your support for the proposed municipal supply well as the selected new Community Water Supply Groundwater Source for the Borough of Bally. Once ARCADIS receives your stated support for this well location, we will prepare a package for submission to the PADEP describing the required infrastructure package to meet PADEP requirements for Community water supply sources.

Sincerely,

ARCADIS G&M, Inc.

Christopher T. Sharpe
Project Scientist

Date:
30 April 2007

Contact
Christopher Sharpe

Phone
267-685-1800

Email
csharpe@arcadis-us.com

Our ref
NP000597.0002.00014

Imagine the result

Copies:
L. Borland
C. A. Gahagan
M. Cron
E. Effiong
Borough Manager
M. Bedard

1. Selection of Well Site

The following provides a description of how the Borough has met its obligations under PA Code: Title 25 Chapter 109.603(a) in selecting the Longacre property as the site with the highest quality water source available and the measures proposed to protect the source from existing or foreseeable sources of contamination.

In selecting the Longacre property as the site with the highest quality water source available, Sunbeam and Bally Borough have satisfied their obligations under PA Code: Title 25 Chapter 109.603(a). ARCADIS, at the request of Sunbeam, began the process of identifying a new location for the well in early 2003. An initial screening was conducted to identify general areas potentially suited to the installation of a new municipal supply well. Based upon the results of this screening and the PADEP requirements for Community Groundwater Supply Sources, a number of potential properties were identified. Numerous meetings were held with various property owners to attempt to secure access for the investigation and installation of a new well. Negotiations were conducted for approximately a dozen properties that passed the initial screening. Temporary access was obtained from three property owners. Pilot borings were installed at each of these locations. One location exhibited positive indications for water of sufficient quantity and quality for a replacement municipal supply well; however, negotiations to secure permanent access to this property were unsuccessful. As a result, Sunbeam resumed access negotiations with other property owners, including owners that had not been initially approached. The result was access to the site where PW-01 is presently located. Therefore, after nearly four years of investigations, PW-01 has been identified as the best attainable location for the new municipal supply well. Presently, there is no storage of chemicals or fuels at the Site and any required future storage will be detailed in the construction plans for the well house and treatment systems to be submitted to PADEP under separate cover. To assure that the long-term operation of PW-01 does not promote adverse migration of the existing chlorinated VOC plume towards the well, sentry well monitoring activities are proposed and planned responses to adverse plume migration have been established, as discussed in Section 7 of the Water Resources Investigation (WRI) Report, and in Attachment C to this Addendum.

2. Surface Water and Wetlands Monitoring

The following presents an analysis of the effects of pumping on surface/near surface water resources.

To evaluate potential groundwater withdrawal impacts to surface water bodies and wetlands, a series of surface water monitoring points and shallow piezometers were established at various stages of the Water Resources Investigation. Surface water monitoring points SP-01 and SW-03 were established to monitor surface water levels associated with the wetlands at the Site. Surface water monitoring point SW-04 was established to monitor surface water levels associated with the stream that borders the Site. Corresponding piezometers PZ-01, PZ-02, PZ-03, and PZ-04 were established to monitor shallow groundwater, less than 5 feet below ground surface (bgs), in the vicinity of the wetlands and stream monitoring points. The locations of these surface water, wetlands, and shallow groundwater monitoring points are shown in **Figure 3** of the WRI Report. Hydrographs prepared from the results of surface water and groundwater monitoring during the final 8-day pumping test (December 5 – 13, 2005) are presented in **Appendix D** of the WRI Report. Review/evaluation of the hydrographs indicated that surface water and shallow groundwater showed little to no discernible response to pumping. Additionally, precipitation events that occurred during and just following the pumping test, 8 inches of snow on December 9[1], 2005, and 2 inches of rain on December 12, 2005, respectively, indicated that natural recharge and runoff cycles had a more significant impact on water levels than pumping. A record of the precipitation events that occurred in Bally Borough during the December pumping test are provided in **Appendix D** of the WRI Report.

As shown in **Figure 3** the wetlands at the Site are located in the central and eastern areas of the Site. The landsurface of the Site slopes from elevated land to the northwest to the lower-lying residential properties to the southeast. The wetlands are at least partially spring fed as groundwater emanates from seeps at various times of the year in the vicinity of the cistern and locations SP-02 and SP-01, and flows as surface water to the southeast. Upon reaching the northeast-southwest property boundary adjacent to the residential parcels, surface water flow is redirected to the

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[1] It should be noted that the snow did not melt for several days and, therefore, would not be expected to have significantly impacted groundwater levels over the timeframe of the pumping test.

southwest via a drainage swale and additional wetlands areas oriented parallel to the Site property boundary. Surface flow from the wetlands areas eventually converges with the stream that flows to the southeast along the southwest property boundary.

The spring box, SP-01, and piezometers in the vicinity, PZ-01 and PZ-02, were located north of the pumping well (PW-01) just inside the northern boundary of the wetlands. Except for some anomalous data points, the data indicate that surface water and shallow groundwater levels were relatively unchanged for this area of the Site as a result of pumping. A chart is provided in **Attachment E** which combines the results of the hydrograph plots presented in **Appendix D** of the WRI Report for the locations SP-01, PZ-01, and PZ-02. At the locations of PZ-01 and PZ-02, the deeper and shallower piezometers, respectively, groundwater appeared to be locally discharging to surface water. Water level elevations for PZ-01 and PZ-02 were 469.92 feet above mean sea level (ft msl) and 467.26 ft msl, respectively, exhibiting an upward gradient at this location. Only the shallower piezometer, PZ-02, showed any decrease in water level during the December pumping event, with water levels decreasing only by hundredths of a foot. The deeper piezometer, PZ-01, showed no discernible response to pumping. Transmission of water-level impacts to the shallower piezometer without impacts to the intervening deeper piezometer (i.e., piezometer located vertically between the pumping stress and the shallower piezometer) is unlikely. The lack of water level decrease in the deeper piezometer (PZ-01) and the very slight water level decrease in the shallower one (PZ-02) suggest that the decrease was not directly related to the pumping but rather the result of the natural surface drainage and wetting cycles that affect this area. Water levels collected on December 9, 2005 for PZ-01 are believed to be anomalously low (or the result of a measurement error) as evidenced by the sudden drop in water levels at this location on the 9th and the apparent rebound of the water levels to approximately the previously measured (prior to the 9th) water levels observed at the time the pump was shut off on December 13, 2005. Additional indications that pumping at PW-01 did not significantly affect surface water levels was provided by the lack of a discernible response to pumping at SP-01. .

Surface water monitoring point SW-03 and piezometer PZ-03 were located downgradient of the pumping well along the swale adjacent to the residential properties. Water level elevations prior to pumping at SW-03 and PZ-03 were 463.11 ft msl and 460.01 ft msl, respectively, thereby showing a downward gradient indicating that surface water at this location was not supplied by shallow groundwater in the immediate vicinity. This indicates that the swale is a losing stream (a condition where a surface water body loses water to shallow groundwater). Surface water levels at SW-03 showed a limited response to pumping with water levels decreasing only

hundredths of a foot. These surface water levels exhibited a much greater response (0.5 foot) as a result of the rainfall event that occurred on December 15, 2005.

Surface water monitoring point SW-04 and piezometer PZ-04 were located at the stream that runs along the southwest property boundary. This portion of the stream appears to be a "gaining" stream (a condition where shallow groundwater discharges to the stream in this area). This condition is consistent with general Site observations at this elevation as groundwater discharges to surface water in several locations. Elevations in the stream and the piezometer prior to pumping were 467.18 ft msl and 467.47 ft msl, respectively. Surface water levels at SW-04, as at PZ-01, were more significantly affected by the precipitation events than by pumping. Water levels at SW-04 decreased by hundredths of a foot following the initiation of the pumping test and increased by tenths of a foot corresponding with both the December 9 and December 15, 2005 precipitation events. Piezometer PZ-04 showed no discernible response to pumping. This would be expected based upon the fact that effects on shallow groundwater were not observed in other areas. Furthermore the decrease in stream level observed at this location is likely related to natural drainage because it would be unlikely for surface water to be affected without shallow groundwater being affected.

In general, surface water-groundwater interactions at the Site appear to behave according to the following pattern. Groundwater appears to discharge to surface water at the western high elevation portions of the Site where the surface slope of the property begins to level out. This relationship is essentially reversed at the eastern portion of the Site where surface water generally recharges shallow groundwater. Pumping of well PW-01 did not significantly influence surface water or shallow groundwater over the course of the 8-day test. Rather, surface water-groundwater interactions were influenced more by precipitation than by the pumping.

3. Aquifer and Well Performance Trends

The following provides an analysis of the influence of pumping by PW-01 and MUN-3 on aquifer and well performance along the NE-SW strike between these wells.

Attached to this Addendum are distance-drawdown graphs (Attachment A) for PW-01 to the southwest through wells MW-01, MW-02, MW-04, MUN-1, and 87-7I, and for MUN-3 to the northeast through the approximate location of well 86-5D (not shown on graph), and wells 87-7I, MUN-1, and MW-04. A review of the graph to the southwest of PW-01 reveals the following trends:

Approaching MUN-1 to the southwest the trace of the observed drawdown diverges from a straight-line relationship of predicted drawdown attributable to well PW-01. This indicates that other influences, such as the pumping at MUN-3, contribute to drawdown in this region of the aquifer. Because of this mutual drawdown interference between wells PW-01 and MUN-3, the drawdown at some wells is a combination of drawdown from each pumping well and not solely attributable to one well or the other. Again, in this plot it is apparent that moving towards well MUN-1 the drawdown deviates from the predicted linear drawdown trend. This again is a result of the mutual drawdown interference of wells PW-01 and MUN-3.

4. Attachments

The following provide a brief description of the Attachment items presented with this Addendum.

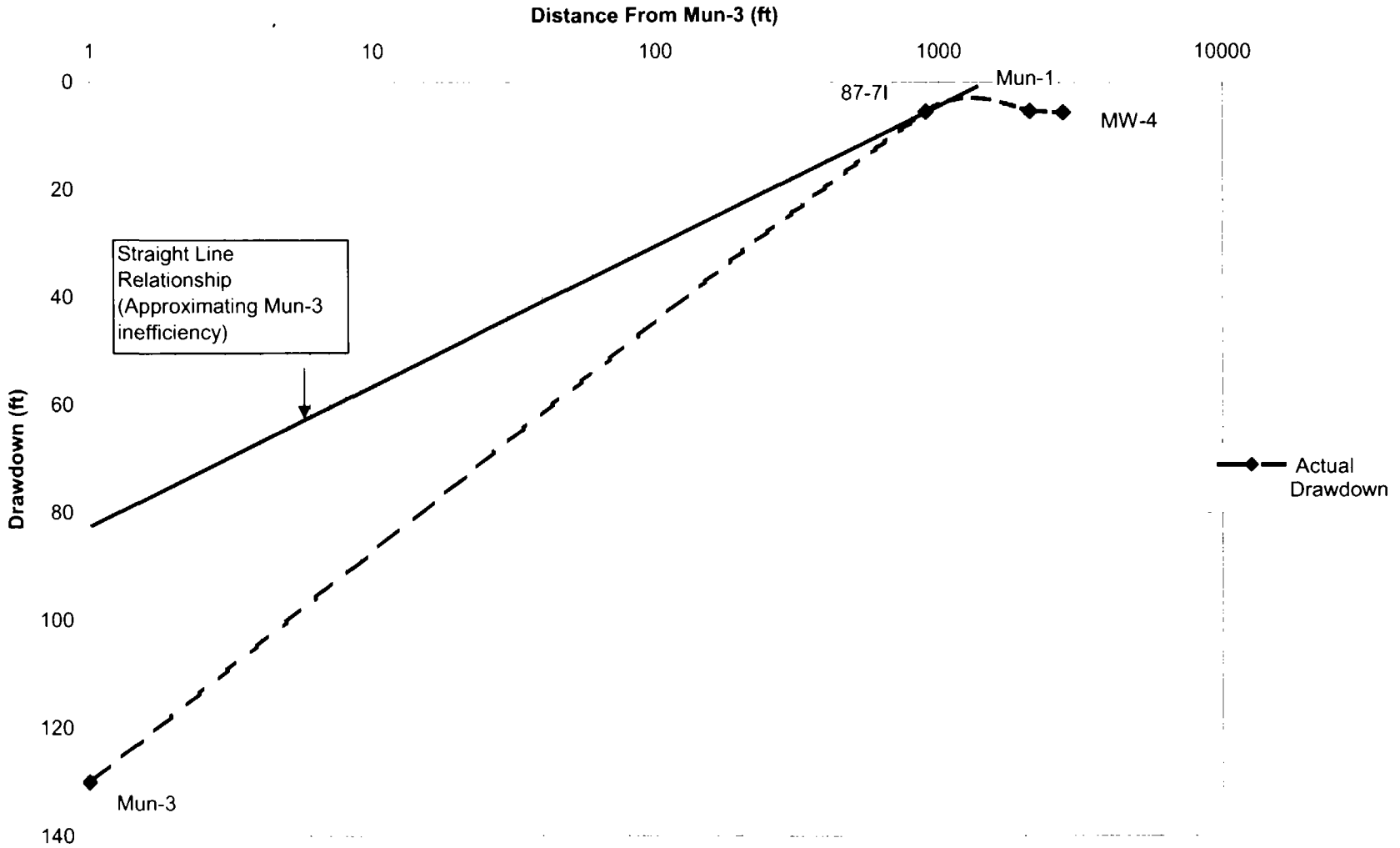
- Attachment A: Distance-Drawdown Plots as provided to Mr. Thomas Fridirici of PADEP on June 30, 2006
- Attachment B: Time-Drawdown Projection as provided to Mr. Thomas Fridirici of PADEP on June 30, 2006
- Attachment C: Plume Management Plan, as provided to Mr. Thomas Fridirici of PADEP on June 30, 2006, and revised 9/18/06, based on revisions submitted to U.S. EPA on September 18, 2006
- Attachment D: Bally Groundwater Surface Profile During December Pumping Test plots Figure 7 of the WRI Report with an expanded scale
- Attachment E: Combined Hydrographs for SP-01, PZ-01, and PZ-02 as referenced in this Addendum
- Attachment F: Replacement Items—the following revised text pages and revised figures replace pages and figures in the WRI Report:
    - Text **Page 9 rev**. replaces **Page 9**, to change the word "non-potable" to "potable"
    - **Figure 2 rev.** replaces **Figure 2**, to identify the Bally Groundwater Site and well 86-5S

- **Figure 4 rev.** replaces **Figure 4**, to show an overlay of the TCE plume area
- **Figure 6 rev.** replaces **Figure 6**, to show an overlay of the TCE plume area
- **Figure 10 rev.** replaces **Figure 10**, to show an overlay of the TCE plume area

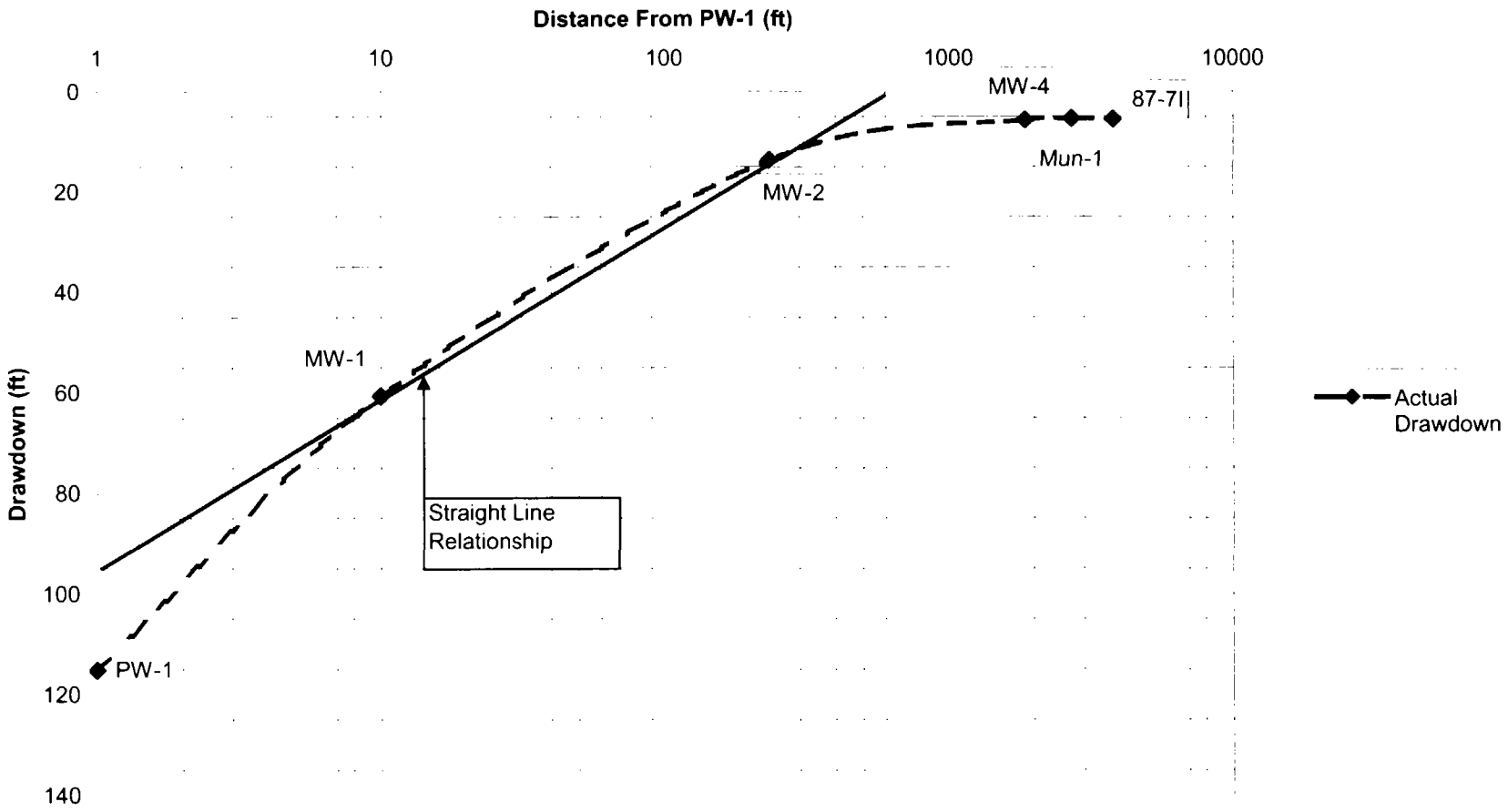
Attachment A

Distance-Drawdown Plots

Drawdown Vs. Distance From Mun-3 to the Northeast



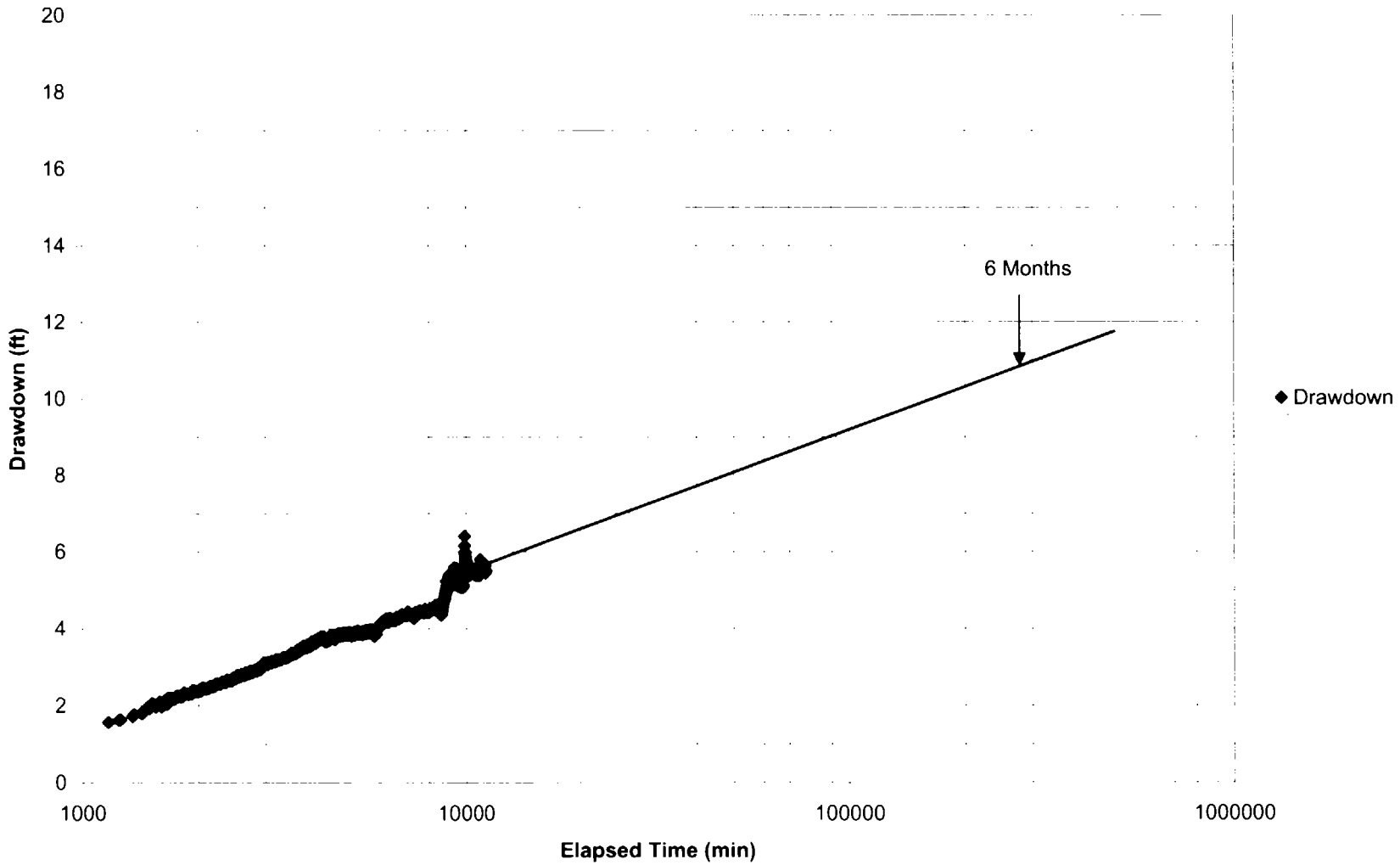
Drawdown Vs. Distance From PW-1 To The Southwest
Bally WRI



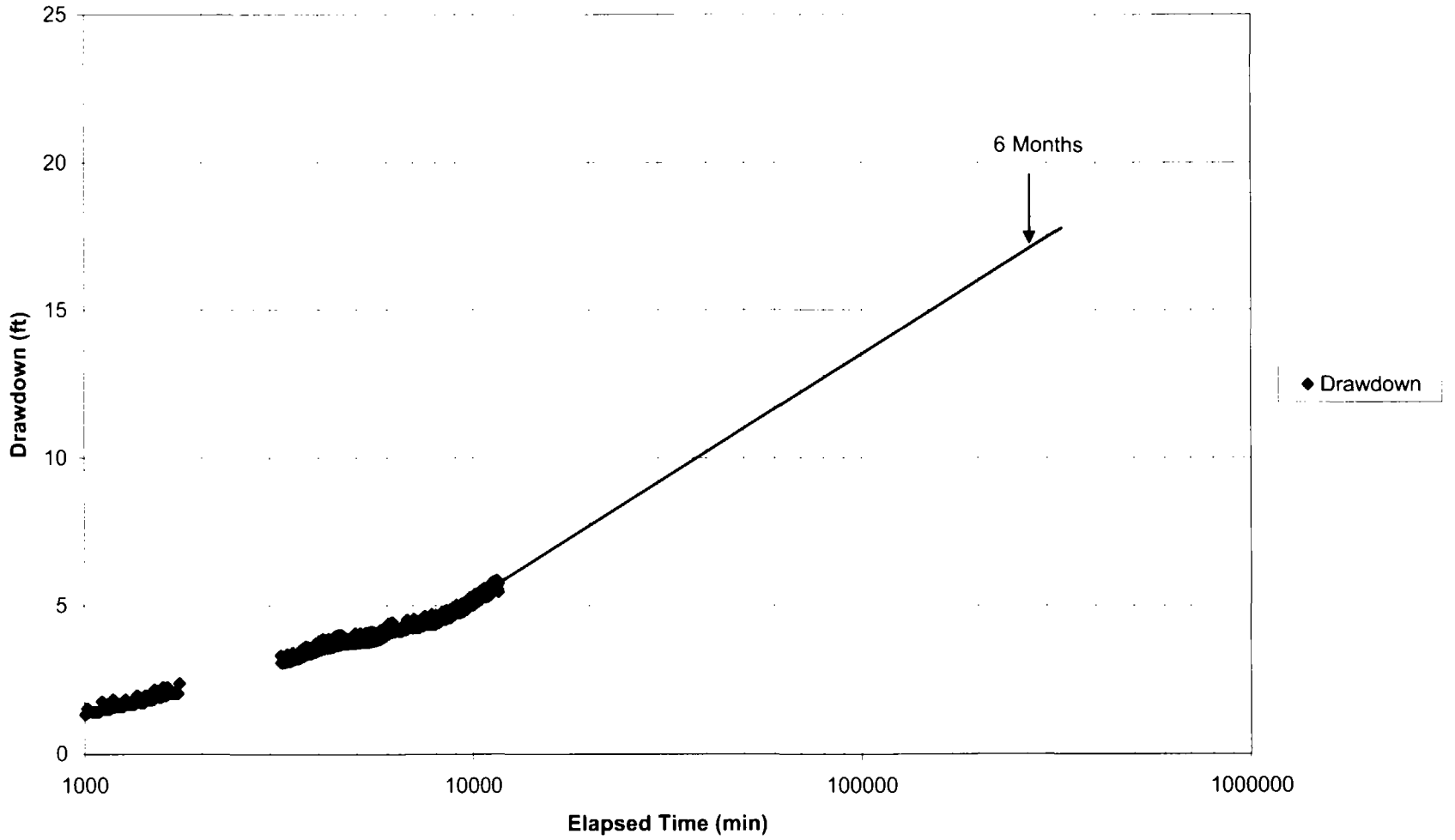
Attachment B

Time-Drawdown Projection

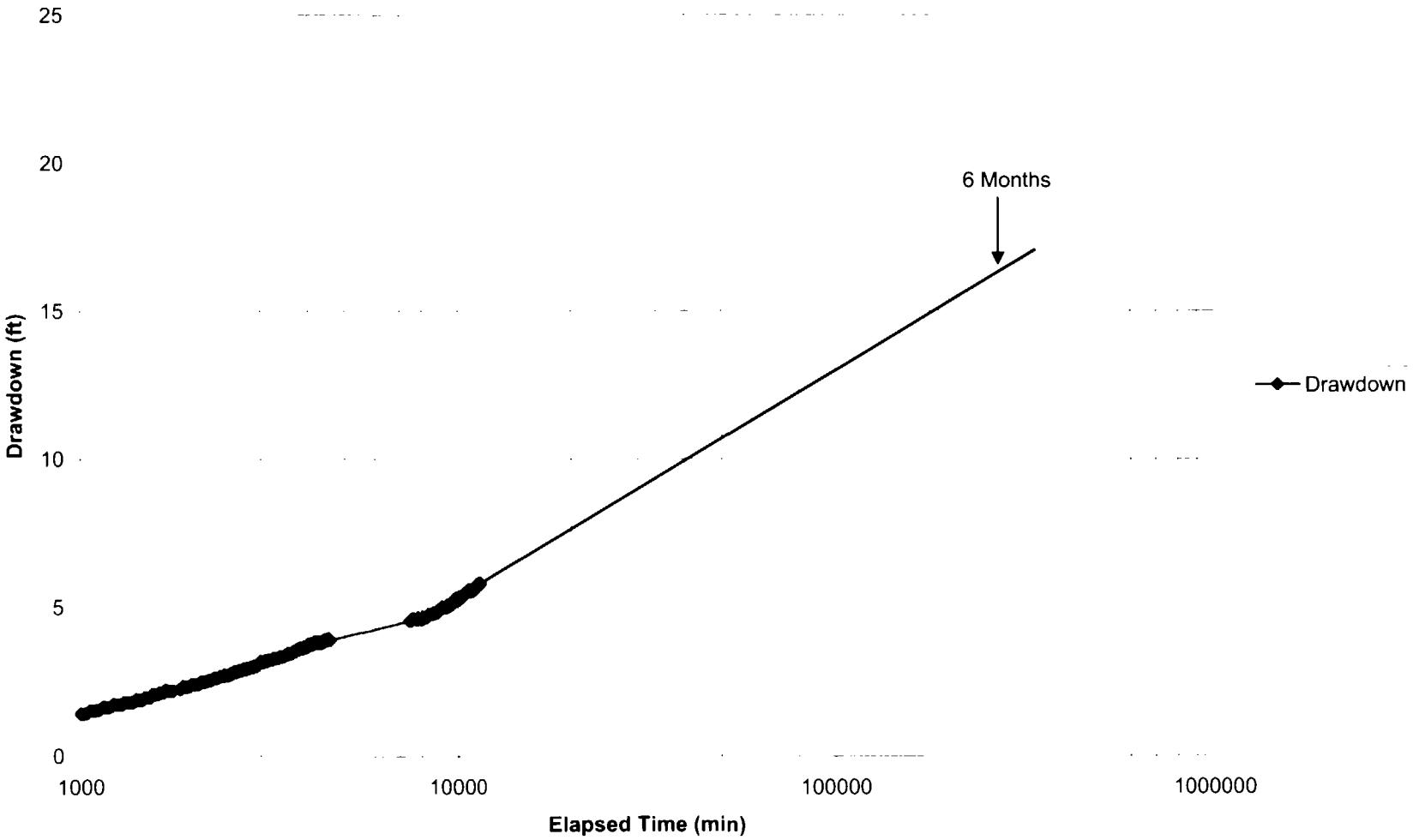
Projection of Drawdown At Well 87-7I Over Six (6) Months Without Recharge



Drawdown Vs. Time At Well Mun-1 With Projection of Drawdown Six Months Out Without Recharge



Drawdown Vs Time At Well MW-4 With Projection of Drawdown Six Months Out Without Recharge



Attachment C

Plume Management Plan, Rev. 9/18/06

Bally PW-01 Sentry Monitoring Program

- **Initial year of PW-01 operation**
  - Monthly water- level measurement in the following wells:
    - PW-1, MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, RW-2, RW-3, RW-7, RW-11, Mun-1, 87-8I, 87-7I, 92-18I, 92-19I, 92-20I, 87-10I, 86-5D, Mun-3, 92-15 and 94-21.
    - Residents who had their wells monitored during the final test will be notified of the residential monitoring program and provided instruction on how to contact the borough in the event that pumping at PW-01 causes a problem with their well.
  - Monthly groundwater samples from the following wells:
    - MW-04, 87-7I, and 86-5D.
  - Semi-annual sampling of MUN-1,
  - Periodic evaluation of chemical and water level data'.

- Reassessment of program at the end of the first year.

- **2nd year of PW-01 operation** (If no significant issues arise based upon ARCADIS assessment.)
  - Quarterly water- level measurement in the following wells:
    - PW-1, MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, RW-2, RW-3, RW-7, RW-11, Mun-1, 87-8I, 87-7I, 92-18I, 92-19I, 92-20I, 87-10I, 86-5D, Mun-3, 92-15 and 94-21.
  - Quarterly groundwater samples from the following wells:
    - MW-04, 87-7I, and 86-5D.
  - Semi-annual sampling of MUN-1, and MW-07 (new deep well Fall 2006); and,
  - Periodic evaluation of chemical and water level data.

- Reassessment of program at the end of the second year.

- **3rd year of PW-01 operation** (If no significant issues based upon ARCADIS assessment).
  - Semi-annual water- level measurement in the following wells:
    - PW-1, MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, RW-2, RW-3, RW-7, RW-11, Mun-1, 87-8I, 87-7I, 92-18I, 92-19I, 92-20I, 87-10I, 86-5D, Mun-3, 92-15 and 94-21.
  - Semi-annual groundwater samples from the following wells:
    - MW-04, 87-7I, and 86-5D.
  - Semi-annual sampling of MUN-1, and MW-07; and,
  - Periodic evaluation of chemical and water level data.

- During the third year of operation (if no significant issues arise based on ARCADIS assessment), the PW-01 plume management program will be rolled into (combined with) the existing plume monitoring program for the Bally Groundwater Contamination Site.

- Possible response actions to interpreted plume migration toward PW-01 are presented in Section 7.2 of the Detailed Hydrogeologic Water Resources Investigation Report.

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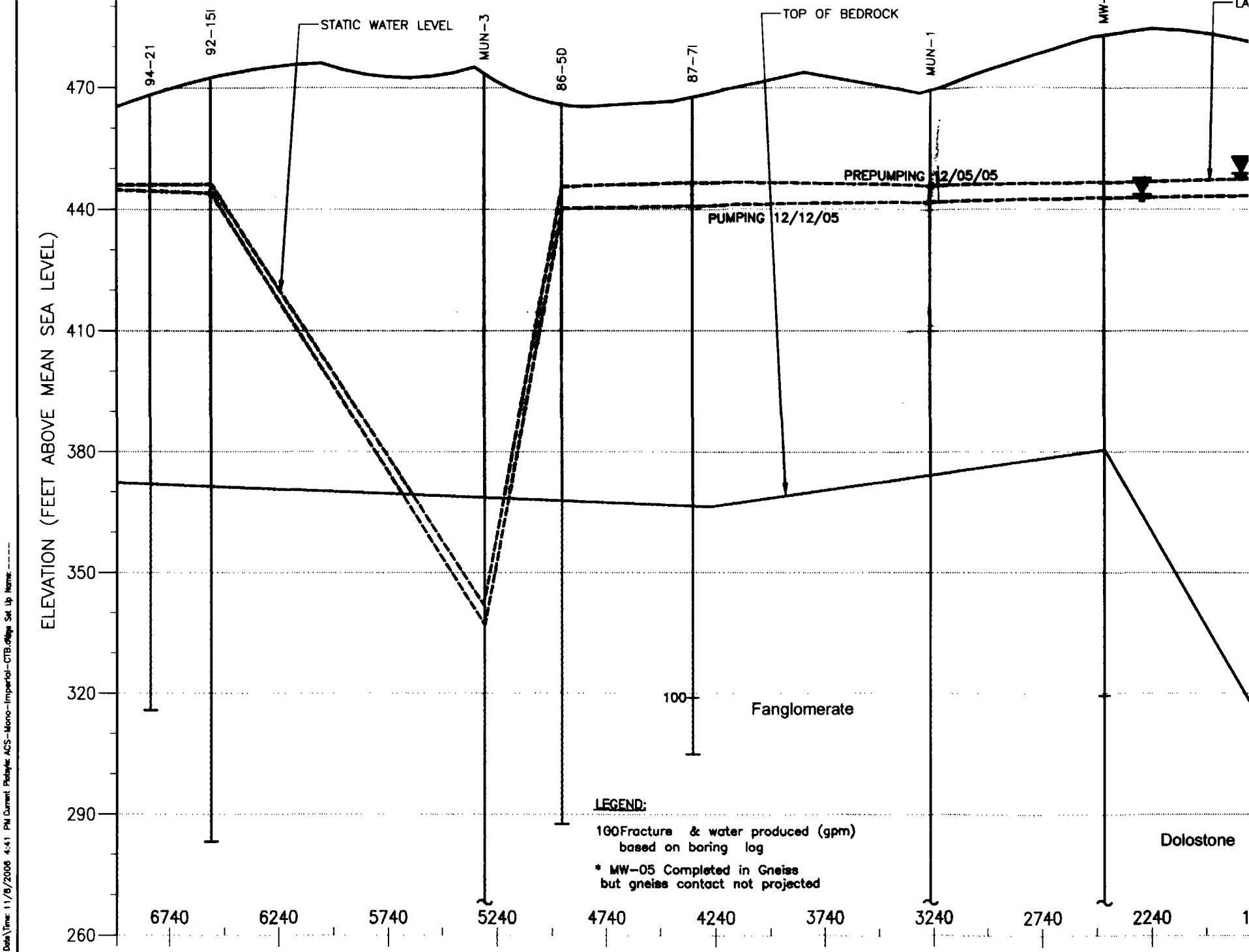
[1] Only qualified and validated data will be used to establish increasing trends and trigger response actions. Estimated and/or suspect data (denoted by "J" flags, "E" flags, "B" flags or their equivalent) will not be used to establish an increasing trend or trigger a response action. Trigger values are established for specific site related COCs and will not be applied to other compounds. In the event that a trigger value is exceeded the data must be confirmed by two subsequent samples both of which clearly indicate that the trigger value has been exceeded. Confirmation samples will be collected at approximately 1 week intervals with theinterval not exceeding two weeks. *It will therefore require three sequential positive, unqualified detections above a trigger* level to mandate a response action.

Attachment D

Bally Groundwater Surface Profile
During December Pumping Test



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ARCADIS GBM, Inc.

Area Manager	A. ROBINSON
Project Director	M. WOLFERT
Task Manager	C. SHARPE

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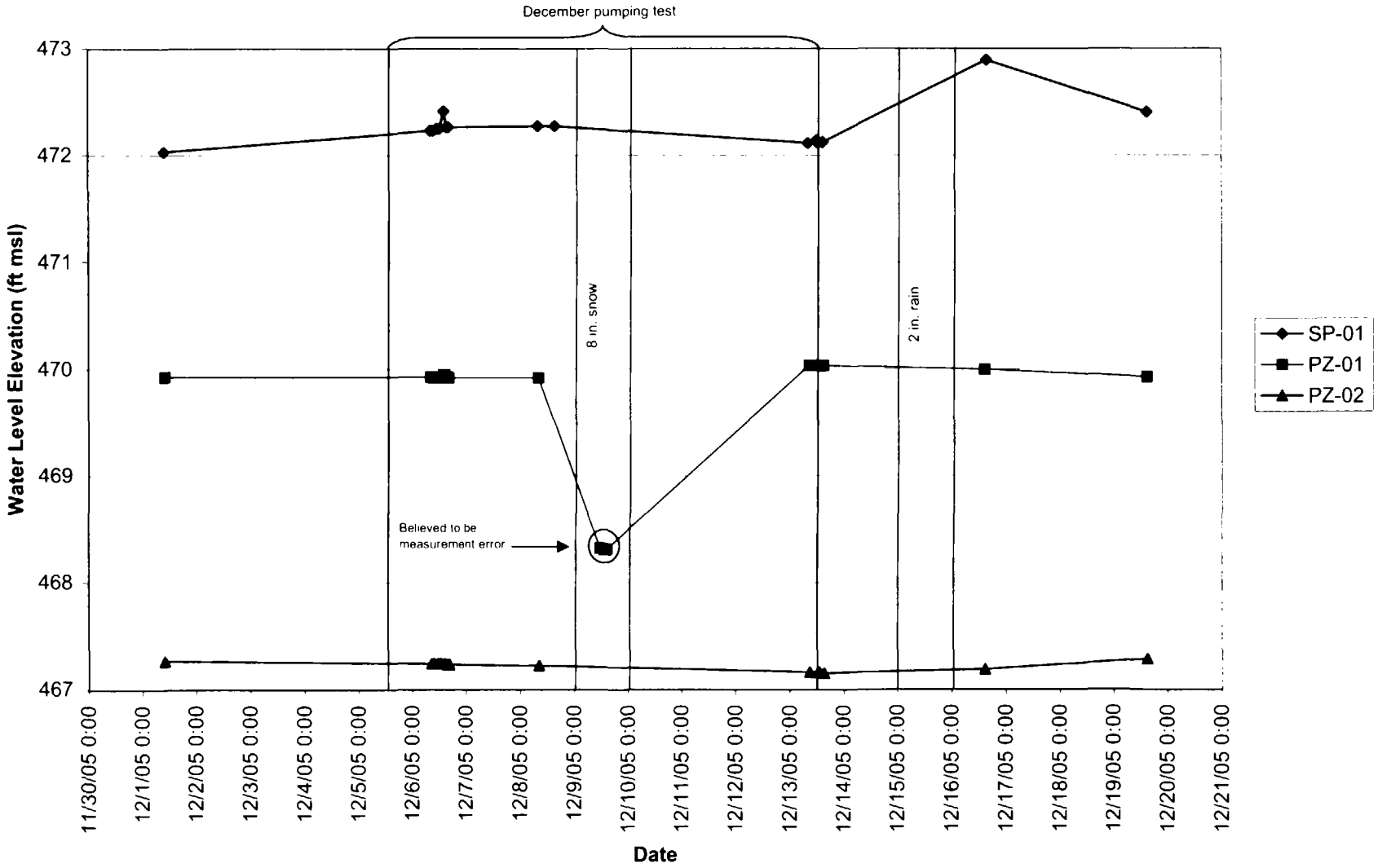
BALLY WATER RESOURCES INVESTIGATION
AR301433
BALLY GROUNDWATER SURFACE PR
CROSS SECTION A-A'

Attachment E

Combined Hydrographs for SP-01, PZ-01, and PZ-02

Combined Hydrographs for SP-01, PZ-01, and PZ-02



Attachment F

Replacement Items

The items in this attachment replace pages and figures provided as part of the original report.

southeastern Pennsylvania, with several benefits being collection of basic hydrologic data and development of detailed, quantitative water budget methodologies (Sloto, 1994; Sloto, 2004; Sloto and Buxton, 2005; Risser, Gburek and Folmar, 2005).

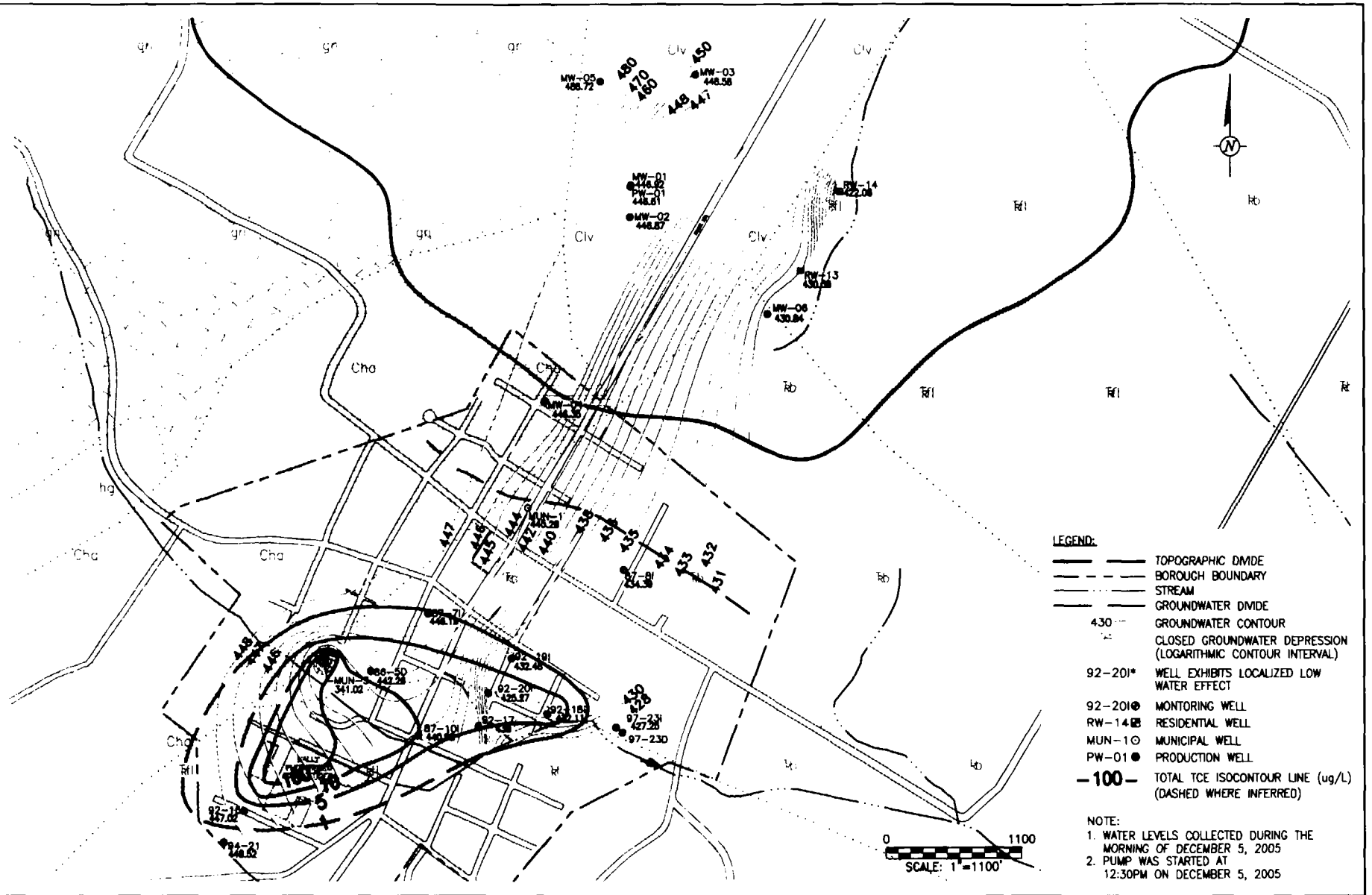
Studies like the above indicate that recharge varies according to many variables, from seasonal climate changes, to plant cover, underlying geology, slope angle and soil thickness; but repeated studies show recharge values for transmissive, fractured rock aquifers in Pennsylvania are on an average annual basis typically in the range of 9 to 12 inches. That is, of the 44 inches of precipitation received annually in a watershed in this region, 9 to12 inches can be expected to infiltrate to groundwater annually. Given the diversity in geology in the vicinity of well PW-01, recharge rates may vary considerably, from several inches atop the gneiss to possibly greater than 12 inches over the solutioned Leithsville Formation.

Given the average range of recharge, and the size of the Upper Main Branch of the Perkiomen Sub-basin at 38 square miles (24,320 acres), approximately 18,240 to 24,320 acre feet or 5.94 to 7.92 billion gallons of water recharge the watershed, move through the underlying aquifer system(s) and discharge to streams as baseflow, on an annual basis. At the Bally design yield of 350 gpm, potential annual withdrawal of groundwater from the Upper Main Branch Watershed at PW-01 is approximately 184.0 million gallons (MG), or approximately 2 to 3% of the available groundwater in the watershed which is recharged on an average annual basis.

Presently most groundwater pumpage in the basin is returned to the basin through septic systems and wastewater treatment plants. Bally is an excellent example of this where approximately 115 million gallons of water are removed from the basin by the Borough each year, of which approximately 58 million gallons are returned immediately to surface water flows within the basin. Additionally, 178 million gallons of treated wastewater is passed through the Bally wastewater treatment plant, based upon the average daily discharge from the wastewater treatment plant.

2.6 Hydrogeology

Groundwater flow in the region occurs largely in a southeasterly direction, approximately normal to the orientation of the Reading Prong. Flow moves from the relatively discrete fractures and recharge areas in the steep basins of the hills down through the Leithsville and Hardyston Formations, and into the deposits of the Newark basin. **Figure 4** shows the water levels in the area on December 5, 2005. Municipal Well Number 3 (MUN-3), used to supply Bally with potable water, operates 24



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Area Manager	A. ROBINSON
Project Director	M. WOLFERT
Task Manager	C. SHARPE
Technical Review	S. POTTER

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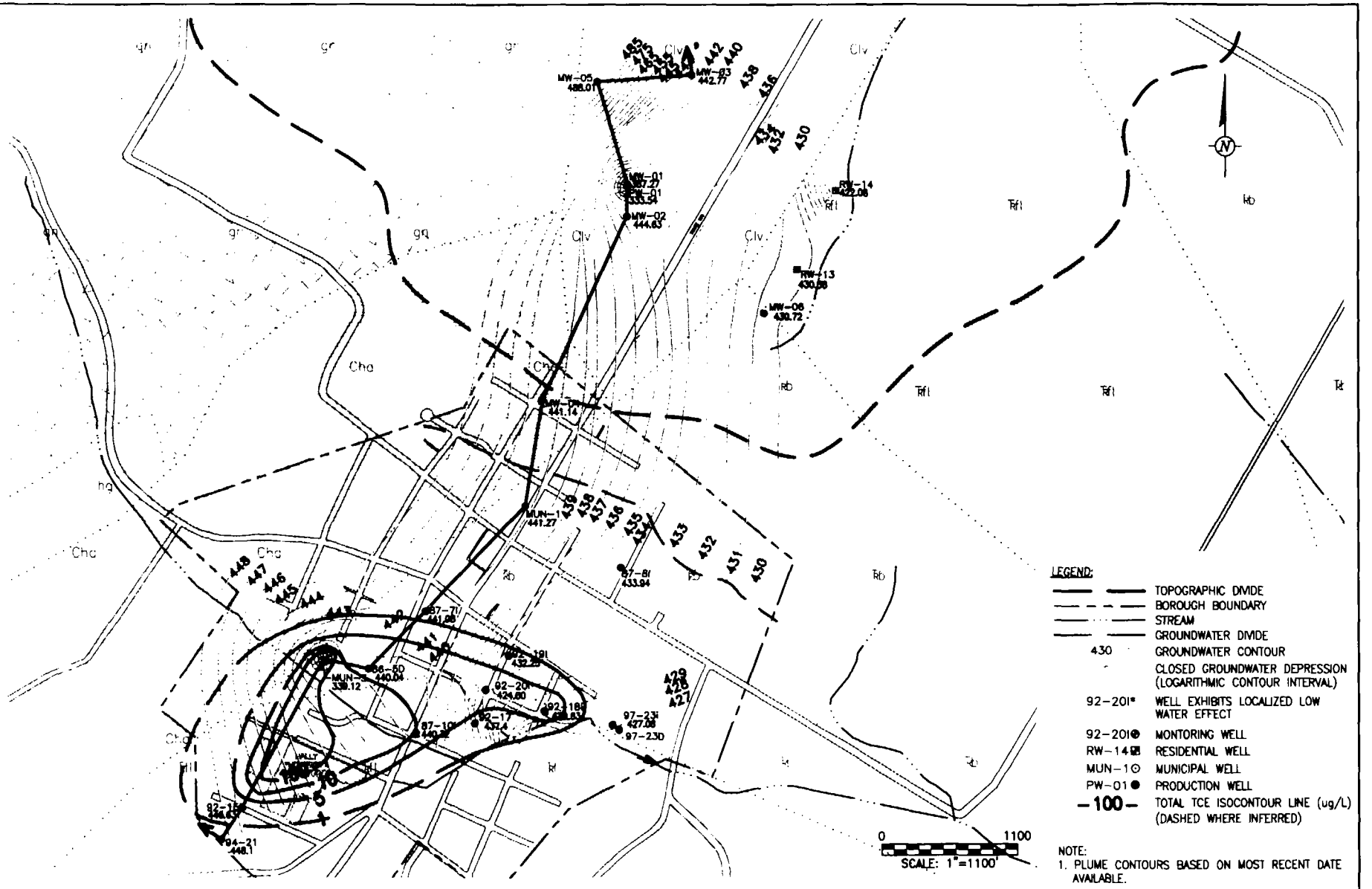
SUNBEAM PRODUCTS INC.
BALLY WATER RESOURCES INVESTIGATION

GROUNDWATER FLOW AND TCE ISOCONTOURS PRIOR TO FINAL PUMPING TEST - DECEMBER 5, 2005

BALLY, PA

Project Number	NP000597.002
Drawing Date	5 JULY 06
Revised	7 NOVEMBER, 2006
Figure	4



Acad Version: 16.2s (LMS Tech) Path\Name: G:\APROJECT\AH Bally, PA\CADD\2005_Well Installation\PADEP_TEST\Report Addendum\REVISED\FIG-06 GROUNDWATER FLOW AND TCE ISOCONTOURS NEAR END OF FINAL PUMPI
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Area Manager	A. ROBINSON
Project Director	M. WOLFERT
Task Manager	C. SHARPE
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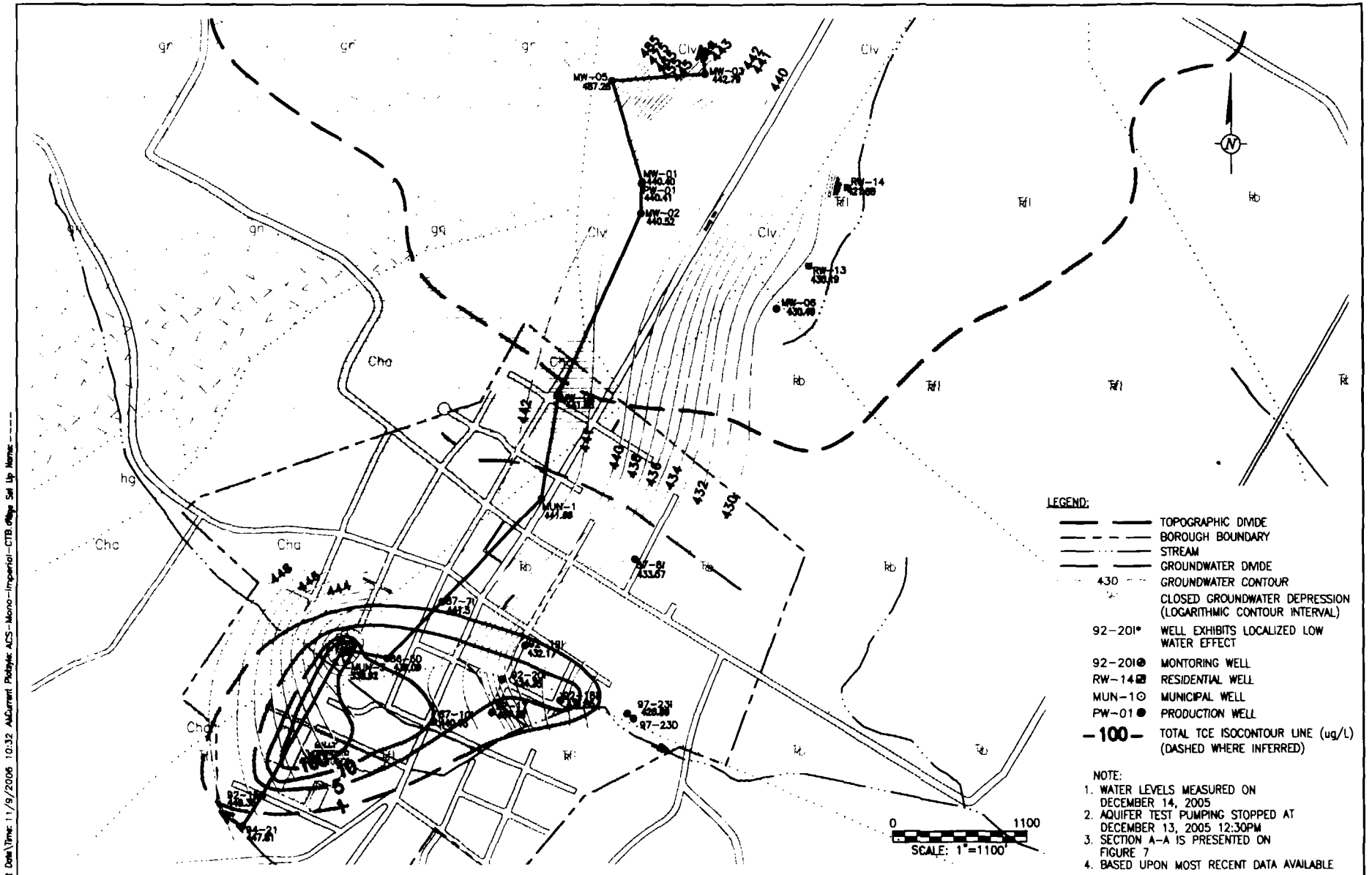
SUNBEAM PRODUCTS INC.
BALLY WATER RESOURCES INVESTIGATION

GROUNDWATER FLOW AND TCE ISOCONTOURS NEAR END OF FINAL PUMPING TEST - DECEMBER 12, 2005

BALLY, PA

Project Number	NP000597.002
Drawing Date	5 JULY 06
Revised	7 NOVEMBER, 2006
Figure	6



Area Manager: A. ROBINSON
Project Director: M. WOLFERT
Task Manager: C SHARPE
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SUNBEAM PRODUCTS INC.
BALLY WATER RESOURCES INVESTIGATION

GROUNDWATER FLOW AND TCE ISOCONTOURS AFTER FINAL PUMPING TEST - DECEMBER 14, 2005

BALLY, PA

Project Number: NP000597.002
Drawing Date: 5 JULY, 2006
Revised: 7 NOVEMBER, 2006
Figure: 10

AR301441

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Imagery Insert Form

Site Name: BALLY GROUNDWATER CONT. **Document ID:** 20810666 PA-0942

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